## 3.19 AIR QUALITY

### 3.19.1 Summary

Prescribed burning can affect air quality through the release of particulates and pollutant gases. Prescribed burning is a temporary source of air pollution. The effects of human interruption of the historical frequent, low-intensity fire regimes through systematic, organized fire suppression on all ownerships in the project area has led to an increase in the amounts of fuel, both living and dead, that are available to burn should a wildfire occur. Under Alternative 1, there would be no direct contribution of additional particulates, although the fuel buildup would continue and some areas would be at greater risk of wildfire and consequently could generate greater amounts of particulates. Alternatives 2 and 3 would contribute a minor amount of particulates through prescribed fire but not enough to adversely affect the overall air quality. In addition, there would be a reduction in the amount of fuel which could limit the amount of particulates when compared to wildfire.

### 3.19.2 Introduction

Concerns were expressed about the impact of smoke from prescribed fire activity in relation to the Glacier Project. The project area contains one of the highest wildland/urban interface densities within the boundaries of the Superior National Forest. Private property with homes and seasonal cabins are scattered throughout the project area. High densities of residential homes occur around Cedar Lake, Fall Lake, Farm Lake, Garden Lake, Moose Lake, Snowbank Lake and White Iron Lake. In addition, the project area contains numerous recreational sites that receive high use throughout the year. Due to this high density wildland/urban interface, smoke sensitive areas can often be quite close to proposed burns. The short distance (less than a mile) between smoke sensitive areas and many of the burns will elevate smoke concerns, even for smaller fires where smoke would normally not be thought of as a potential issue.

#### Regulatory and Policy Issues

Minnesota Smoke Management Plan

The Superior National Forest and other principal wildland fire and air quality regulatory agencies in Minnesota have worked together to prepare a joint Smoke Management Plan (SMP) for the State of Minnesota. These include the member agencies of the Minnesota Incident Command System and the Minnesota Pollution Control Agency, as well as the National Weather Service. The SMP includes all the requirements for burners in Minnesota to meet the above regulations and protect public health. These requirements are to be included in burn plans. The SMP and the EPA Exceptional Events Rule (EPA, 2007) generally state that exceedances of the National Ambient Air Quality Standard (NAAQS) measured by EPA-certified monitors that are caused by wildland fire don't automatically cause a non-attainment designation by EPA as long as the SMP was followed and/or the fire event can be classified as natural. In either case, improvements to the plan could be proposed to enhance its performance in the future.

#### Historical Wildfire Emissions

The Boundary Waters Canoe Area Wilderness (BWCAW) Air Quality Assessment (Air Sciences, Inc., 2000), completed in April 2000, estimated wildfire emissions in the BWCAW from 1727 to 1972. Information and conclusions from this Assessment can be applied to air quality in the Glacier Project Area. The project area is adjacent to the BWCAW and has similar meteorology as the BWCAW.

The air pollutant focused on here is particulate matter smaller than 2.5 micrometers in aerometric diameter, known as $PM_{2.5.}$ The Assessment found that the range of acres burned in the BWCAW each decade was from 640 to 445,440 acres (there was no data for some decades). This is recognized to be an underestimate of the total amount of fire that was present on the land over that time because low-intensity, surface fires that did not leave evidence of their presence through fire scars or other means and would not be detected. Nevertheless the $PM_{2.5}$ emissions produced from these fires ranged from 1,000 to 1,536 tons per average fire day. On an average fire-day, the average $PM_{2.5}$ concentrations ranged from thirty-two to fifty ug/$m^3$ (on a twenty-four-hour average basis). This suggests that during decades that experienced many fires, the present day NAAQS of thirty-five ug/$m^3$ for $PM_{2.5}$ were exceeded on some days.

Visibility conditions (measured as standard visual range) on an average stand-replacement-fire day were estimated to range from sixteen to twenty-four miles. These values can be compared with the visibility conditions within the BWCAW monitored in the 1980's and 1990's by the Forest Service. These measured values are thirty-three, seventy, and 116 miles, for the $10^{th}$, $50^{th}$, and $90^{th}$ percentile conditions, respectively. This indicates that historical, high-fire days likely had a marked impact on visibility.

### 3.19.3 Analysis Methods

**Indicator 1:** Particulate-matter emissions from burning and other Forest Service activities

This indicator is effective in highlighting the differences between alternatives because the health and welfare effects of both smoke from burning and dust from other forest service activities are directly related to the concentration of particulate matter in the air which is itself related to the emissions of this material from the land.

### 3.19.4 Analysis Area

The analysis area used for this resource is the project area along with adjacent areas of the BWCAW. This area was chosen because smoke from the majority of these fires would travel only within the project area or in some cases beyond the project area and into the BWCAW. The project would be implemented during the next ten years, so effects from burning would occur during that time period. The actual duration of the effects from smoke would occur only on the day when burning occurred. The effects of the smoke are of short duration because of wind, which disperses the smoke. Smoke may or may not impact areas with human occupation depending on the direction of the wind.

### 3.19.5 Affected Environment

#### Current Air Quality

Data from permanent, EPA-certified air pollutant monitors was examined to get the most accurate picture of the existing air quality, As mentioned above, the air pollutant focused on here is particulate matter smaller than 2.5 micrometers in aerometric diameter, known as PM2.5. Combustion sources of all types are the major sources of PM2.5. PM2.5 is also a major cause of visibility degradation due to its ability to absorb and scatter light.

The Minnesota Pollution Control Agency (MPCA) operates a monitoring network statewide to measure PM2.5. This network is used to determine if Minnesota is in attainment with the PM2.5 NAAQS. Current monitoring data indicates that the entire state of Minnesota will meet the new NAAQS of thirty-five ug/m3 for PM2.5 standard. The current overall condition of the air resource in

northern Minnesota (as represented by the monitor located in Virginia), in reference to PM2.5, is the best in the state. Values further from Virginia would be even lower in concentration as they would be more distant from air emission sources on the Iron Range. (MPCA, 2007).

The area in and around the forest is currently subject to air pollutants from internal combustion engines (e.g., vehicles, snowmobiles, outboard motors, and chain saws) and industrial sources (e.g. taconite plants and power plants). Because of the low level of emissions by these sources and/or dispersion of these emissions by wind over long distances, the reference above shows that pollutants from these sources typically do not attain high enough concentrations to exceed the PM2.5 standard.

Wildfire is also a source of air emissions. In recent years (1995 – 2006), an average of ten wildfires per year occurred in the project area. These fires averaged less than one quarter acre in size. However, large fires have occurred near the project area recently; Turtle Lake in 2006 and Little Gabbro in 1991. Both were in the BWCAW. Wildfires occur most often in the spring, when humidity is low and fuel is dry from long, sunny days, and late-summer/early-fall, during periods of drought. However, some wildfires also occur in the summer. In the spring, summer, and fall, another source of smoke emissions is from private and public landowners burning brush piles. During periods of intense wildfire activity in Ontario, smoke can sometimes be observed and smelled in the project area.

Problems arise when smoke drifts into areas of concern, called "sensitive receptors." Sensitive receptors are areas where smoke and air pollutants can adversely affect public health, safety, and/or welfare. Private property with homes and seasonal cabins are scattered throughout the project area. High densities of residential homes occur around Cedar Lake, Fall Lake, Farm Lake, Garden Lake, Moose Lake, Snowbank Lake and White Iron Lake. In addition, the project area contains numerous recreational sites that receive high use throughout the year. The communities of Ely and Winton are near the project area.

### 3.19.6 Environmental Consequences

In this section, emissions from prescribed fire treatments under each of the alternatives are compared. Also compared are the potential emissions from wildfire in a stand that has not been treated to a stand that has been treated.

#### 3.19.6.1 Direct and Indirect Effects

A computer model, First Order Fire Effects Model (FOFEM) (http://fire.org/), was used to assess the impacts of wildfire and prescribed fire on air quality in the project area for broadcast burns and underburns. ***CONSUME*** was used for pile burns (www.fs.fed.us/pnw/fera). Consume is a computer model(v 3.0) which reflects the improved understanding of fuel consumption and emissions in wildland fire throughout major fuel types in the United States.Both programs use entered fuels information and environmental conditions to predict the fuel consumption, and emissions of a burn, and are used for planning and predicting fire effects. While they can predict total emissions of particulate matter of concern for comparison purposes, they cannot predict concentrations in the atmosphere at various distances from the actual burn. Dispersion of emissions is a factor of several atmospheric conditions, such as mixing height, stability, and transport wind speed and direction on the day of the burn. These factors cannot be predicted ahead of time, and assigning assumed values to them would make subsequent dispersion modeling results arbitrary. For prescribed fire, the optimal conditions for dispersion of smoke can be incorporated into the burn prescription.

The amount of emissions produced in a fire, whether prescribed or wild, is a factor of the total fuel consumed by the fire. The drier the fuels, the greater the fuel consumption, fire intensity, and emissions that would be produced during the fire. Table 3.19-1 shows the comparative emissions produced by a prescribed underburn in red and white pine, a crown fire in an untreated red and white pine stand under extreme fire weather conditions, and a surface fire that would be predicted to occur in a previously treated red and white pine stand under extreme fire weather conditions.

**Table 3.19-1. Comparison of PM Emissions (lbs. per acre) for Prescribed Fire (Underburn) in Red/White Pine, Crown Fire in Untreated Red/White Pine, and Surface Fire in Treated Red/White Pine.**

| | Prescribed Fire | Crown Fire | Surface Fire |
|---|---|---|---|
| PM2.5 Emissions | 73.3 | 405.9 | 227.0 |

Total acres of prescribed burning treatment are shown in Table 3.19-2. Total emissions (in tons) are summarized in Table 3.19-3 for all types of prescribed burns. These do not vary by alternative.

**Table 3.19-2. Prescribed Fire Acreage for Project**

| Alternative | Underburn | Broadcast Burn | Total |
|---|---|---|---|
| **All Action** | 729 | 278 | 1007 |

**Table 3.19-3. Tons of $PM_{2.5}$ Emissions for Project**

| Alternative | Broadcast and Underburn | Slash Pile Burn | Total |
|---|---|---|---|
| **All Action** | 122 | 14 | 136 |

*Data does not reflect emissions from wildfires that may occur due to lack of fuel reduction treatment.

Source: FOFEM runs September 2007.

There would be minor short-term and localized adverse effects to air quality for the action alternatives that include prescribed fire. Adverse effects of smoke produced by prescribed burning would be mitigated by using the Operational Standard S-AQ-1 from the Forest Plan (follow the SMP). During a large wildfire, the majority of the emissions would occur at one point in time; that is, over a few days. For the project, emissions would occur over the next ten years, as the prescribed burns were done allowing the impacts of these emissions to be reduced by being spread over a large period of time.

### Alternative 1 (No-action)

Under Alternative 1, there would be no new treatment activities, so there would be no new emissions from prescribed fire. However, emissions would be more severe if a wildfire started. Wildfires are

expected to produce greater emissions than prescribed burns. Based upon a hypothetical stand under extreme weather conditions, a wildfire that resulted in a crown fire would produce 5.5 times more PM2.5 emissions than those produced during a prescribed fire (Table 3.12-2).

Wildfires generally burn under more extreme dryness and heat conditions with lower fuel moistures than prescribed fires, leading to greater consumption of fuels, as well as surface leaf and pine needle litter. In a crown fire, the needles and smaller branches of the tree canopy, as well as the surface fuels, are consumed, producing even greater emissions than a surface fire. When conditions are very dry, larger diameter, downed woody fuels and duff (i.e., the organic soil layer) can be consumed as well. They are rarely consumed in flaming combustion, but often smolder after the main fire has passed and thus have higher potential to emit large amounts of residual smoke. Wildfires could occur at any time during the spring, summer, or fall. Depending on the location of a wildfire, smoke from it could seriously impair visibility in portions of the project area, which could create a hazard for motor travel. It could also affect visibility in the BWCAW and Voyageurs National Park. Smoke and haze would diminish the scenic landscape and lower the quality of the experience for some users.

### Alternatives 2 and 3

Fuel reduction, site preparation burns, and slash pile burns would be accomplished under the action alternatives. The amount of particulates generated is about 136 tons of PM2.5. These acres would be burned over a ten-year period. Because prescribed burning would also reduce the potential for crown fire in these stands, any subsequent wildfire would likely only be a surface fire so it would consume less fuel and therefore emit less PM2.5.

When viewed from a historical perspective, the amount of particulate released over the life of the project is about one tenth of what was released on an average fire-day in the BWCAW (1,000-1,536 tons, see section on Historical Wildfire Emissions). In addition the emissions from the project will be released over a number of years versus a few days with a wildfire. These fire emissions would be within the natural range of the fire emissions seen pre-settlement and therefore not contribute to visibility impairment in the BWCAW. Other Class I air-quality related values are not expected to be impacted.

As a general rule, the higher the emissions and the shorter amount of time over which these emissions are released, the higher the potential for adverse air quality impacts. Prescribed fires of any size can be managed so that air quality impacts are not adverse (e.g. the NAAQS are not exceeded). The mitigation strategies used are site and time specific to each prescribed burn. Emissions from prescribed fire, by using the Operational Standard S-AQ-1 from the Forest Plan (i.e. using strategies described in the Minnesota State SMP), will not be as high as would be expected to occur with a wildfire on the same sites. In addition, public and firefighter health and property would be protected by implementing the State SMP. The emissions that were generated would be managed so that the NAAQS are not exceeded.

All levels of prescribed fire have temporary, short-term, usually localized, negative impacts on air quality. Based on experience with similar fires, the underburns and broadcast burns with the Project are expected to produce smoke for only one burning period (one day). There are many options available to mitigate the impacts to any sensitive receptor for only one day. The pile burns may generate smoke for a longer period of time (1 to 3 days) but the amount of smoke generated is much less (see table 3.12-4) so the potential for impacts is also much less.

### 3.19.6.2 Cumulative Effects

Within the past ten years, the district has completed 2,790 acres of fuel reduction treatments within or adjacent to the project area. Types of treatments include prescribed burning, pile burning, crushing, and burning. The 1999 blowdown event led to several prescribed burning projects adjacent to the project area inside the BWCAW. The effects of these past burns are no longer measurable and would not contribute towards cumulative effects.

There are five units encompassing 5,592 acres planned for prescribed burning adjacent to the project area over the next three to five years. With regards to air quality, the effects of these treatments are short-term and include smoke impacts, machinery (airplane, helicopter, and pumps) and increased dust on roads due to increased traffic during the burns.

All prescribed burns in the project area would be implemented by West Zone Forest Fire staff. Consequently, the timing of these burns would be highly coordinated and the chance of their emissions impacting the same area simultaneously would not be likely.

County, state, and private landowners also conduct burning activities (e.g. pile burning) on a regular basis. However, these activities are limited and would not significantly add to the cumulative impacts from the fuel treatments because of the small scale of the fires and short duration. The impact of burning on other ownerships may or may not be independent of the burning activity represented in the project because there is no way to know if these burns would occur in close proximity and within a day or two of each other.